WHAT IS CLAIMED IS:

1. A method comprising the steps of:

   a) fabricating a nanostructured template; and

   b) growing low-defect three-dimensional wide bandgap nanostructures in said nanostructured template.

2. The method of Claim 1, wherein the nanostructured template is fabricated by a lithographic method selected from the group consisting of block co-polymer lithography, electron-beam lithography, extreme UV lithography, embossing (nano-imprinting), 2-dimensional colloidal crystal lithography, soft lithography, and combinations thereof.

3. The method of Claim 1, wherein the three-dimensional wide bandgap nanostructures are grown by a method selected from the group consisting of CVD, MOCVD, laser ablation, atomic layer deposition, liquid phase epitaxy, high pressure temperature-gradient recrystallization, high pressure solution growth, sublimation, and combinations thereof.

4. The method of Claim 1, wherein the wide bandgap nanostructures have less than about $1x10^6$ dislocations cm^{-2}.

5. The method of Claim 1, wherein the wide bandgap nanostructures have less than about $1x10^4$ dislocations cm^{-2}.

6. A device comprising:

a) a substrate; and

b) nanostructures of wide bandgap material, wherein the nanostructures of wide bandgap material comprise an n-type portion and a p-type portion and wherein the nanostructures of wide bandgap material are selected from the group consisting of low-defect nanostructures of wide bandgap material, quantum confined nanostructures of wide bandgap material, surface confined nanostructures of wide bandgap material, and combinations thereof.

7. The device of Claim 6, wherein the substrate comprises a conductive material.

8. The device of Claim 6, further comprising a nucleation layer interposed between the substrate and the nanostructures of wide bandgap material.

9. The device of Claim 8, wherein the substrate comprises a material selected from the group consisting of SiC, sapphire, ZnO, doped Si, AlN, InN, AlGaN, AlInGaN, $LiGaO_2$, SiO_2, diamond, and combinations thereof.

10. The device of Claim 8, wherein the nucleation layer comprises a material selected from the group consisting of GaN, InGaN, AlN, InN, BN, $B_xAl_yIn_zGa_{1-x-y-z}N$, and combinations thereof.

11. The device of Claim 6, wherein the substrate comprises bulk GaN, wherein the bulk GaN has a dislocation density of less than about 10^4 cm^{-2}.

12. The device of Claim 6, wherein the nucleation layer and the wide bandgap nanostructures comprise a common material.

13. The device of Claim 6, wherein the wide bandgap nanostructures comprise a material selected from the group consisting of group III nitrides, III-V semiconductors, II-VI semiconductors, $Al_xGa_{1-x}As$, $In_xGa_{1-x}As$, II-VI semiconductors, AlP, AlAs, AlSb, GaP, GaN, GaAs, GaAs, GaSb, InP, InAs, InSb, SiC, ZnO_2, and combinations thereof.

14. The device of Claim 6, wherein the wide bandgap nanostructures are selected from the group consisting of quantum dots, quantum wires, and combinations thereof.

15. The device of Claim 6, wherein the wide bandgap nanostructures are selected from the group consisting of nanostructures that are homogeneous in size and shape, nanostructures that are heterogeneous in size and shape, and combinations thereof.

16. The device of Claim 6, wherein the p-type portion of the wide bandgap material is p-doped with atoms selected from the group consisting of Zn, Mg, Mn, C, Co, Ca, Ra, Be, Sr, Ba, Zn, Ga-vacancies, and combinations thereof.

17. The device of Claim 6, wherein the n-type portion of the wide bandgap material is n-doped with atoms selected from the group consisting of oxygen, Si, Co, C, nitrogen vacancies, and combinations thereof.

18. The device of Claim 6, wherein the wide bandgap nanostructures are arranged with a density which ranges from about 10^8 nanostructures per square centimeter to about 10^{12} nanostructures per square centimeter.

19. The device of Claim 6, further comprising electrodes, wherein at least one electrode is in ohmic contact with an n-type region and at least one electrode is in ohmic contact with a p-type region of the nanostructures of wide bandgap material.

20. The device of Claim 6, further comprising at least one cladding layer.

21. The device of Claim 19, wherein said device is operable as a solid state optical emitter.

22. The device of Claim 21, wherein said device is operable as a light emitting diode.

23. The device of Claim 21, wherein said device is operable as a laser diode.

24. The device of Claim 21, wherein said device provides for light selected from the group consisting of polychromatic radiation, monochromatic radiation, coherent radiation, and combinations thereof.

25. A method comprising the steps of:

a) depositing a nucleation material over a substrate layer to form a nucleation layer; and

b) forming nanostructures of wide bandgap material comprising an n-type portion and a p-type portion such that p-n junctions are formed within the nanostructures, wherein the nanostructures of wide bandgap material are selected from the group consisting of low-defect nanostructures of wide bandgap material, quantum confined nanostructures of wide bandgap material, surface confined nanostructures of wide bandgap material, and combinations thereof, and wherein at least one portion of the nanostructures of wide bandgap material is in contact with the nucleation layer.

26. The method of Claim 25, wherein forming nanostructures of wide bandgap material comprises the steps of:

a) contacting at least one nano-lithographically patternable material with the nucleation layer;

b) nano-lithographically patterning the nano-lithographically patternable material with a lithographic means to form molds for nanostructures of wide bandgap material;

c) depositing an n-doped wide bandgap material into said molds to form nanostructures of n-doped wide bandgap material; and

d) depositing a p-doped wide bandgap material in contact with the n-doped wide bandgap material to form wide bandgap nanostructures of wide bandgap material comprising at least one p-n junction.

27. The method of Claim 26, wherein the nano-lithographically patternable material comprises:

a) an etchable layer; and

b) a block co-polymer material.

28. The method of Claim 27, wherein the etchable layer is selected from the group consisting of a sacrificial dielectric layer, a semiconducting layer, and combinations thereof.

29. The method of Claim 26, wherein the lithographic means comprises block co-polymer lithography, electron-beam lithography, extreme UV lithography, embossing (nano-imprinting), 2-dimensional colloidal crystal lithography, soft lithography, and combinations thereof.

30. The method of Claim 26, wherein the wide bandgap material is deposited with a means selected from the group consisting of vapor deposition, MOCVD, CVD, molecular beam epitaxy, laser ablation, atomic layer deposition, liquid phase epitaxy, high pressure temperature graded recrystallization, high-pressure solution growth, sublimation, and combinations thereof.

31. The method of Claim 26, wherein the wide bandgap material is doped as it is deposited in the molds.

32. The method of Claim 25, further comprising a step of applying a potential across the p-n junctions of the nanostructures so as to effect electroluminescence.

33. The method of Claim 32, wherein the electroluminescence provides light selected from the group consisting of polychromatic light, monochromatic light, white light, coherent light, and combinations thereof.

34. The method of Claim 32, wherein the electroluminescence is tuned by a method selected from the group consisting of modulating the degree of quantum confinement, modulating the degree of surface confinement, and combinations thereof.

35. A laser diode comprising:

a) a first metal contact layer;

b) a first external Bragg reflector;

c) a substrate;

d) a first cladding layer;

e) an active layer comprising a layer of monodisperse nanostructures of wide bandgap material, wherein the nanostructures of wide bandgap material are selected from the group consisting of low-defect nanostructures of wide bandgap material, quantum confined nanostructures of wide bandgap material, surface confined nanostructures of wide bandgap material, and combinations thereof;

f) a second cladding layer;

g) a second external Bragg reflector; and

h) a second metal contact layer.

36. The laser diode of Claim 35, wherein at least one of the first layer and the second layer is transparent.

37. A device comprising:

a) a substrate;

b) a first cladding layer disposed on the substrate;

c) at least one nanostructured layer disposed on the first cladding layer, wherein the at least one nanostructured layer comprises a wide band gap material selected from the group consisting of low-defect nanostructures of wide band gap material, quantum confined nanostructures of wide bandgap material, surface confined nanostructures of wide bandgap material, and combinations thereof; and

d) a second cladding layer disposed on the at least one nanostructured layer.

38. The device of Claim 37, wherein the first cladding layer is an n-type cladding layer and the second cladding layer is a p-type cladding layer.

39. The device of Claim 37, wherein the first cladding layer is a p-type cladding layer and the second cladding layer is an n-type cladding layer.

40. The device of Claim 37, wherein the first cladding layer and the substrate comprise the same material.

41. The device of Claim 37, wherein the first cladding layer and the substrate form a single layer.

42. The device of Claim 37, wherein the at least one nanostructured layer comprises at least one of a monodisperse array of wide band gap nanostructured material, a variable sized array of wide band gap nanostructured material, and combinations thereof.

43. The device of Claim 37, wherein the a monodisperse array of wide band gap nanostructured material comprises an elongated array of wide band gap nanostructured material.

44. The device of Claim 37, further comprising a nucleation layer disposed between the substrate and the first cladding layer.

45. The device of Claim 37, where the substrate comprises bulk GaN, wherein the bulk GaN has a dislocation density of less than about 10^4 cm^{-2}.

46. The device of Claim 37, wherein the substrate comprises a conductive material.

47. The device of Claim 37, wherein the substrate comprises a material selected from the group consisting of SiC, sapphire, ZnO, doped Si, AlN, InN, AlGaN, AlInGaN, $LiGaO_2$, SiO_2, diamond, and combinations thereof.

48. The device of Claim 37, wherein the wide bandgap nanostructures comprise a material selected from the group consisting of group III nitrides, III-V semiconductors, II-VI semiconductors, $Al_xGa_{1-x}As$, $In_xGa_{1-x}As$, II-VI semiconductors, AlP, AlAs, AlSb, GaP, GaN, GaAs, GaAs, GaSb, InP, InAs, InSb, SiC, ZnO_2, and combinations thereof.

49. The device of Claim 37, wherein the wide bandgap nanostructures are selected from the group consisting of quantum dots, quantum wires, and combinations thereof.

50. The device of Claim 37, wherein the wide bandgap nanostructures are selected from the group consisting of nanostructures that are homogeneous in size and shape, nanostructures that are heterogeneous in size and shape, and combinations thereof.

51. The device of Claim 37, wherein the wide bandgap nanostructures are arranged on the nucleation layer with a density which ranges from about 10^8 nanostructures per square centimeter to about 10^{12} nanostructures per square centimeter.

52. The device of Claim 37, wherein said device is operable as a solid state optical emitter.

53. The device of Claim 52, wherein said device is operable as a light emitting diode.

54. The device of Claim 52, wherein said device is operable as a laser diode.

55. The device of Claim 52, wherein said device provides for light selected from the group consisting of polychromatic radiation, monochromatic radiation, coherent radiation, and combinations thereof.